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SWEDISH STANDARDS INSTITUTE

SVENSK STANDARD SS-EN 10270-2

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Steel wire for mechanical springs – Part 2: Oil hardened and tempered spring steel wire

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Fjädertråd – Del 2: Oljehärdad fjädertråd av olegerat stål (ventilfjädertråd)

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ICS 77.140.25; 77.140.65

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 10270-2

April 2001

ICS 77.140.25; 77.140.65

English version

Steel wire for mechanical springs - Part 2: Oil hardened and tempered spring steel wire

Fils en acier pour ressorts mécaniques - Partie 2: Fils en acier trempés à l'huile et revenus

Stahldraht für Federn - Teil 2: Ölschlußvergüteter Federstahldraht

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Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 30 "Steel wires ", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2001, and conflicting national standards shall be withdrawn at the latest by October 2001.

This European Standard for steel wire for mechanical springs is composed of the following parts:

Part 1 : *Patented cold drawn unalloyed spring steel wire*

Part 2 : *Oil hardened and tempered spring steel wire*

Part 3 : *Stainless spring steel wire*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

1.1 This Part of EN 10270 applies to oil hardened and tempered spring steel wire made from unalloyed or alloyed steels. They are primarily subject to torsional stresses such as in compression and extension springs and in special cases also for applications where the spring wire is subject to bending stresses such as lever springs.

As a rule unalloyed steels are used for applications at room temperature whereas alloyed steels are generally used at a temperature above room temperature. Alloyed steels may also be chosen for above average tensile strengths.

1.2 In addition to this part of EN 10270 the general technical delivery requirements of EN 10021 are applicable.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 10002-1, *Metallic materials — Tensile test — Part 1: Method of test (at ambient temperature)*

EN 10021, *General technical delivery requirements for steel and iron products*

EN 10204, *Metallic products — Types of inspection documents*

EN 10218-1:1994, *Steel wire and wire products — General — Part 1: Test methods*

EN 10218-2:1996, *Steel wire and wire products — General — Part 2: Dimensions and tolerances*

ENV 10247, *Micrographic examination of the non-metallic inclusion content of steels using standard pictures*

CR 10261, *Iron and steel — Review of available methods of chemical analysis*

EN ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

EU 104[1)], *Determination of the decarburzation depth of unalloyed and low alloyed structural steels*

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1) It may be agreed at the time of ordering, until this EURONORM has been adopted as a European Standard, that either this EURONORM or a corresponding national standard should be applied.

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3 Terms and definitions

For the purposes of this standard the following terms and definition apply.

3.1
oil hardened and tempered spring steel wire
wire that is heat treated in line in the following way: it is first transformed into austenite, quenched in oil or similar quenching medium, followed immediately by tempering by heating to the appropriate temperature

4 Classification and designation

4.1 Classification

This standard deals with all types of hardened and tempered spring steel wire. The grade for normal applications made from unalloyed or alloyed steel has the abbreviation FD and is intended for static applications.

Spring steel wire for medium fatigue levels, such as required for some clutch springs from unalloyed or alloyed steel, has the abbreviation TD.

Spring steel wire from unalloyed steel or alloyed steel intended for use under severe dynamic duty such as for valve springs or other springs with similar requirements has the abbreviation VD.

The diameter ranges for the various wire grades are shown in Table 1.

Table 1 — Spring wire grades

Tensile strength	Static	Medium fatigue	High fatique
Low tensile strength	FDC	TDC	VDC
Medium tensile strength	FDCrV	TDCrV	VDCrV
High tensile strength	FDSiCr	TDSiCr	VDSiCr
Diameter range (mm)	0,50 - 17,00	0,50 - 10,00	0,50 - 10,00

Medium and high fatigue grades TD and VD are characterized by high steel cleanliness, specific chemical, mechanical and technological parameters and a well defined surface condition in relation to the allowable depth of surface defects and decarburization.

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The static grade FD is characterized by its chemical, mechanical and technological characteristics as well as by a specified surface condition concerning surface defects and decarburization.

4.2 Designation

For products supplied according to this standard the designation shall state the following in the following order:

— the term: spring wire;

— the number of this European Standard : EN 10270-2;

— the abbreviation for the wire grade (see Table 1);

— the required nominal diameter selected from Table 4 or Table 5;

EXAMPLE: Standard designation of an oil hardened and tempered steel spring wire according to this standard of wire grade VDC with a nominal diameter of 2,50 mm :

Spring wire EN 10270-2 - VDC - 2,50.

5 Information to be supplied by the purchaser

The purchaser shall clearly state in his enquiry or order the product and following information :

a) the desired quantity;

b) the number of this European Standard: EN 10270-2;

c) wire grade (see 4.1);

d) the nominal wire diameter;

e) the form of delivery and unit mass;

f) the type of inspection document;

g) any particular agreement made.

EXAMPLE: 5 t spring wire EN 10270-2 - VDC - 2,50

in coils of about 300 kg

inspection document EN 10204 - 3.1.B.

6 Requirements

6.1 Form of delivery

6.1.1 Oil hardened and tempered wire shall be supplied in coils, on spools or in cut lengths. The wire in coils or on spools shall form one continuous length. Wire in coil may also be supplied on carriers containing one or more coils.

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For 'VD' and 'TD' grades no welds are permitted after the heat treatments preceding the final drawing operation; for 'FD' grades no welds shall be made at finished size unless agreed otherwise between the parties.

6.1.2 The supplied wire units shall be tightly bound to ensure that wire spiral waps do not spring out unforeseen. The starting end shall be marked and at the coil ends the wire shall be covered with a protective cap.

6.2 Surface finish

The wire shall be protected against corrosion and mechanical damage. Unless otherwise specified the wire shall be delivered in slightly oiled condition.

6.3 Chemical composition

The steel is characterized by the heat analysis which shall be in accordance with the values of Table 2. The permissible deviation of the product analysis from the limiting values of heat analysis shall be in accordance with Table 3.

6.4 Non metallic inclusions

The 'VD' grades shall be checked for maximum size of inclusion according to ENV 10247. The allowable level of inclusions shall be agreed between the parties at the enquiry and order.

6.5 Mechanical properties

For tensile strength R_m and reduction in area after fracture (Z) the wire grades shall satisfy the values listed in Tables 4 and 5. Reduction of area is measured only for size 1,00 mm and above (see Tables 4, 5 and 11).

The range of the tensile strength values within a coil/reel shall not exceed 50 MPa for the grades 'VD', 60 MPa for the grades 'TD' and 70 MPa for the grades 'FD'.

Table 2 — Chemical composition, % by mass

Grade	C	Si	Mn [a]	P max.	S max.	Cu max.	Cr	V
VDC	0,60-0,75	0,15-0,30	0,50-1,00	0,020	0,020	0,06	[b]	
VDCrV	0,62-0,72	0,15-0,30	0,50-0,90	0,025	0,020	0,06	0,40-0,60	0,15-0,25
VDSiCr	0,50-0,60	1,20-1,60	0,50-0,90	0,025	0,020	0,06	0,50-0,80	
TDC	0,60-0,75	0,10-0,35	0,50-1,20	0,020	0,020	0,10	[b]	
TDCrV	0,62-0,72	0,15-0,30	0,50-0,90	0,025	0,020	0,10	0,40-0,60	0,15-0,25
TDSiCr	0,50-0,60	1,20-1,60	0,50-0,90	0,025	0,020	0,10	0,50-0,80	
FDC	0,60-0,75	0,10-0,35	0,50-1,20	0,030	0,025	0,12	[b]	
FDCrV	0,62-0,72	0,15-0,30	0,50-0,90	0,030	0,025	0,12	0,40-0,60	0,15-0,25
FDSiCr	0,50-0,60	1,20-1,60	0,50-0,90	0,030	0,025	0,12	0,50-0,80	

[a] Manganese may be ordered with restricted range, but with a minimum range of 0,20 %

[b] For heavy wire diameter (above 8,5 mm) chromium may be added up to 0,30 % for proper through hardening.

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Table 3 — Permissible deviation of the product analysis from the limiting values for the heat analysis

Chemical element	Wire grade	Permissible deviation, % by mass
C	All	± 0,03
Si	SiCr	± 0,05
	other grades	± 0,03
Mn	All	± 0,04
P	All	+ 0,005
S	All	+ 0,005
Cu	All	+ 0,02
Cr	All	± 0,05
V	All	± 0,02

Table 4 — Mechanical and technological properties and quality requirements for wire grades FDC, FDCrV and FDSiCr

1	2	3	4	5	6	7	8	9	10	11
Nominal wire diameter (mm)	Permissible deviations mm	Tensile strength R_m			Minimum reduction in area after fracture Z for wire grades			Minimum number of torsions for wire grades[a]		
		FDC [b] MPa	FDCrV [b] MPa	FDSiCr [b] MPa	FDC %	FDCrV %	FDSiCr %	FDC	FDCrV	FDSiCr
$d = 0{,}50$	± 0,010	1900 to 2100	2000 to 2200	2100 to 2300	-	-	-	-	-	-
$0{,}50 < d \leq 0{,}60$		1900 to 2100	2000 to 2200	2100 to 2300						
$0{,}60 < d \leq 0{,}80$		1900 to 2100	2000 to 2200	2100 to 2300				To be agreed upon	To be agreed upon	To be agreed upon
$0{,}80 < d \leq 1{,}00$	± 0,015	1860 to 2060	1960 to 2160	2100 to 2300						
$1{,}00 < d \leq 1{,}30$	± 0,020	1810 to 2010	1900 to 2100	2070 to 2260	45	45	45			
$1{,}30 < d \leq 1{,}40$		1790 to 1970	1870 to 2070	2060 to 2250						
$1{,}40 < d \leq 1{,}60$		1760 to 1940	1840 to 2030	2040 to 2220						
$1{,}60 < d \leq 2{,}00$	± 0,025	1720 to 1890	1790 to 1970	2000 to 2180						
$2{,}00 < d \leq 2{,}50$		1670 to 1820	1750 to 1900	1970 to 2140						
$2{,}50 < d \leq 2{,}70$		1640 to 1790	1720 to 1870	1950 to 2120						
$2{,}70 < d \leq 3{,}00$	± 0,030	1620 to 1770	1700 to 1850	1930 to 2100						
$3{,}00 < d \leq 3{,}20$		1600 to 1750	1680 to 1830	1910 to 2080						
$3{,}20 < d \leq 3{,}50$		1580 to 1730	1660 to 1810	1900 to 2060	42	42	42			
$3{,}50 < d \leq 4{,}00$		1550 to 1700	1620 to 1770	1870 to 2030						

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